

Project #4
16F877A PICMicro programming under MPLAB
Due: February 7, 2023

Instructor: Dr. Hanna Bullata

Fun Application

We would like to build a fun application that involves running a string on a 16×2 LCD and a push button P . We'll assume that the running string will be composed of up to 5 characters max.

The behavior of the system can be explained as follows:

1. When the system is powered up, the first line of the LCD should display the message **Enter String**.
2. On the second line, we'll have a blinking cursor on the first location of the second row (leftmost character). The character **A** is displayed in the location of the blinking cursor. when we click on the push button P for the first time, the letter **B** should be displayed in the location where the cursor is blinking. Further clickings should display the letters **C** all the way to **Z** with each click of P . Clicking on P when the letter **Z** is showing up will display the empty character (or space character). Of course, clicking on P when the empty character is showing up will make the letter **A** show up again and so on.
3. If we leave P unclicked for over 2 seconds, the blinking cursor moves to the right and the letter **A** will show up at that location. The same behavior explained above applies to that LCD location. However, if we leave P unclicked for over 2 seconds when the current location displays the empty or space character, that should mean that the string entry is over and thus we should proceed to the next step. Else, the blinking cursor moves to the right and the letter **A** will show up at that location. The same behavior explained above applies for the successive letters for up to 5 characters.
4. When the string entry process is over, the LCD screen will be emptied and stay in the blank mode for 1 second.
5. When the period of 1 second is over, the provided string in the previous steps will enter on the first LCD row, 1 character at a time every half-a-second starting from the last character. After each period of half-a-second, the string will move to the right by 1 location.
6. When the first character of the string leaves the first LCD row from the right, the string will start entering on the second LCD row from the right to the left, 1 character at a time every half-a-second starting by the first string character.
7. When the last character of the string leaves the second LCD row from the left, the behavior is repeated from the first row as explained above in step 5 and so on.
8. If during the string running process the push button P is clicked at any point, we go back to the top and repeat the same steps starting from 1.

What you should do

- Build the controller described above on a bread board. Remember to add a $10\text{K}\Omega$ pull-up resistor to push button P (or use the internal weak pull-up resistor if using PortB), add a 4MHZ oscillator (with $2 \times 15\text{pF}$ capacitors) and a $4.7\text{K}\Omega$ pull-up resistor to the MCLR pin.
- Use the LCD in the 4-bit mode. Connect pin D_4 of the LCD to RA_0 , pin D_5 to RA_1 , pin D_6 to RA_2 , pin D_7 to RA_3 , pin RS to RA_4 and pin E to RA_5 .
- Build the PIC assembly code that implements the behavior described above under MPLAB IDE.
- Assemble your code and make sure you get a successful build. Use the simulator if you wish to make sure the behavior is correct.
- Send the zipped folder that contains the MPLAB project (including your source code) before the deadline. If the deadline is reached and you are still having problems with your code, just send it as is!